MHT CET 2026 PCM Apr 16 Shift 1 Question Paper

Conducted by the State Common Entrance Test Cell, Maharashtra

Time Allowed: 180 Minutes **Total Questions: 150** **Maximum Marks: 200**

General Instructions

(i) This **PCM** paper is from **MHT CET 2026**, conducted by the **State Common Entrance Test Cell, Maharashtra**.

(ii) Answer all **150 multiple choice questions**: **50 Physics**, **50 Chemistry** and **50 Mathematics**.

(iii) Each question offers **four choices**, with **one correct answer**.

(iv) Allow **90 minutes for Physics and Chemistry together**, followed by **90 minutes for Mathematics**. The first group closes before the second opens.

(v) Correct answers earn **1 mark in Physics and Chemistry** and **2 marks in Mathematics**.

(vi) There is **no negative marking**. Unanswered questions score zero.

1. A wire has mass (0.3 ± 0.003) gram, radius (0.5 ± 0.005) cm and length (6 ± 0.06) cm. The maximum percentage error in the measurement of density is

(A) 2 %
(B) 3 %
(C) 4 %
(D) 5 %

2. Let $\vec{P} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{Q} = -(\hat{i} + \hat{j} + \hat{k})$. The angle between $(\vec{P} - \vec{Q})$ and $\vec{P}$ is

(A) 90°
(B) 60°
(C) 0°
(D) 30°

3. A ball is released from height 'h' which makes perfectly elastic collision with ground. The frequency of periodic vibratory motion is (g=acceleration due to gravity)

(A) $\frac{1}{2}\sqrt{\frac{g}{2h}}$
(B) $\frac{1}{2}\sqrt{\frac{2h}{g}}$
(C) $\frac{1}{2\pi}\sqrt{\frac{g}{2h}}$
(D) $\frac{1}{2\pi}\sqrt{\frac{2h}{g}}$

4. Two boys are standing at points A and B on ground where distance AB = a. The boy at point B starts running perpendicular to line AB with velocity 'V_1'. The boy at point A starts running simultaneously with velocity 'V' and catches the other boy in time 't'. The value of 't' is

(A) $\left[\frac{a^2}{(V^2 - V_1^2)}\right]^{\frac{1}{2}}$
(B) $\left[\frac{a^2}{(V_1^2 - V^2)}\right]^{\frac{1}{2}}$
(C) $\left[\frac{a^2}{(V^2 - V_1^2)}\right]$
(D) $\left[\frac{a^2}{(V_1^2 - V^2)}\right]$

5. A particle is moving with constant angular acceleration $4\,\text{rad/s}^2$ in circular path. At what time the magnitudes of its tangential acceleration and centripetal acceleration will be equal ?

(A) 0.2 s
(B) 0.4 s
(C) 0.5 s
(D) 0.6 s

6. A particle describes a horizontal circle of radius 'r' in conical funnel with smooth inner surface with a speed of 0.5 m/s. The height of the plane of the circle from the vertex of the funnel is (acceleration due to gravity, $g = 10\,\text{m/s}^2$)

(A) 1.5 cm
(B) 2.5 cm
(C) 3.5 cm
(D) 0.5 cm

7. A block of mass 'm' moving on a frictionless horizontal surface collides with a spring of spring constant 'K' and compresses it through a distance 'x'. The maximum momentum of the block after collision is

(A) zero
(B) $\sqrt{\text{km}}\,x$
(C) mx^2/K
(D) $\text{Kx}^2/2\text{m}$

8. A Solid sphere has mass M and radius R. Its moment of inertia about a parallel axis passing through a point at a distance R/3 from its centre is

(A) $8\text{MR}^2/11$
(B) $11\text{MR}^2/15$
(C) $23\text{MR}^2/45$
(D) $13\text{MR}^2/20$

9. The masses and radii of the earth and moon are M_1, R_1 and M_2, R_2 and respectively, Their centres are at a distance 'd' apart. The minimum speed with which body of mass 'm' should be projected from a distance $2d/3$ from the centre of M_1 so as to escape to infinity is

(A) $\sqrt{\frac{6G}{d}(2M_1 + M_2)}$
(B) $\sqrt{\frac{6G}{d}(M_1 - 2M_2)}$
(C) $\sqrt{\frac{3G}{d}(M_1 + 2M_2)}$
(D) $\sqrt{\frac{8G}{d}(M_1 - 2M_2)}$

10. A rectangular block of mass 'm' and cross-sectional area 'A' floats on a liquid of density 'ϱ'. It is given a small vertical displacement from equilibrium, it starts oscillating with frequency (g=acceleration due to gravity)

(A) $2\pi\sqrt{\frac{\text{m}}{\text{A}\varrho\text{g}}}$
(B) $2\pi\sqrt{\frac{\text{A}\varrho\text{g}}{\text{m}}}$
(C) $\frac{1}{2\pi}\sqrt{\frac{\text{A}\varrho\text{g}}{\text{m}}}$
(D) $\frac{1}{2\pi}\sqrt{\frac{\text{m}}{\text{A}\varrho\text{g}}}$

11. A closed pipe containing liquid showed a pressure P_1 by gauge. When the valve was opened, pressure was reduced to P_2. The speed of water flowing out of the pipe is (ϱ=density of water)

(A) $\left[\frac{(P_1 - P_2)}{\varrho}\right]^{\frac{1}{2}}$
(B) $\left[\frac{2(P_1 - P_2)}{\varrho}\right]^{\frac{1}{2}}$
(C) $\left[\frac{(P_2 - P_1)}{\varrho}\right]^{\frac{1}{2}}$
(D) $\left[\frac{2(P_2 - P_1)}{\varrho}\right]^{\frac{1}{2}}$

12. Water flows through a horizontal pipe at a speed 'V'. Internal diameter of the pipe is 'd'. If the water is emerging at a speed 'V_1' then the diameter of the nozzle is

(A) $d\sqrt{\frac{V}{V_1}}$ (B) $d\sqrt{\frac{V_1}{V}}$

(C) $\frac{dV}{V_1}$ (D) $\frac{dV_1}{V}$

13. A liquid is at rest in a container. In a sphere of influence, the liquid molecule at its centre is

(A) attracted by other molecules in the sphere of influence.

(B) attracted by other molecules outside sphere of influence.

(C) repelled by other molecules outside the sphere of influence.

(D) repelled by other molecules in the sphere of influence.

14. Rate of flow of heat through a cylindrical rod is 'H_1'. The temperature at the ends of the rod are T_1 and T_2. If all the dimensions of the rod become double and the temperature difference remains the same and if the rate of flow of heat becomes 'H_2' then $H_2 =$

(A) $\frac{H_1}{2}$ (B) $4H_1$

(C) $2H_1$ (D) $\frac{H_1}{4}$

15. The energy spectrum of a black body exhibits a maximum around a wavelength 'λ'. The temperature of the black body is now changed such that the energy is maximum around a wavelength $2\lambda/3$. The power radiated by the black body will now increase by a factor

(A) $\frac{9}{4}$ (B) $\frac{81}{16}$

(C) $\frac{3}{2}$ (D) $\frac{27}{8}$

16. A black rectangular surface of area 'A' emits energy 'E' per second at 27°C. If length and breadth is reduced to half of its initial value and temperature is raised to 327°C then energy emitted per second becomes

(A) $2E$ (B) $4E$

(C) $8E$ (D) $16E$

17. A monoatomic gas at pressure P having volume V expands isothermally to a volume 3V and then adiabatically to a volume 81 V. The final pressure of the gas is ($\gamma = 5/3$).

(A) $\frac{P}{3}$ (B) $\frac{P}{(3)^2}$

(C) $\frac{P}{(3)^4}$ (D) $\frac{P}{(3)^6}$

18. An ideal gas at 27°C is compressed adiabatically to $\left(\frac{8}{27}\right)$ of its original volume. If $\gamma = 5/3$, then the rise in temperature of a gas is

(A) 300 K (B) 675 K

(C) 375 K (D) 27 K

19. The translational kinetic energy of the molecules of a gas at absolute temperature (T) can be doubled by

(A) increasing T to 4 T (B) increasing T to $\sqrt{2}$ T

(C) decreasing T to T/2 (D) increasing T to 2T

20. For a particle P performing S.H.M., when displacement is 'x', potential energy and restoring force acting on it is denoted by 'E' and 'F' respectively. The relation between x, E and F is

(A) $\frac{2E}{F} - x = 0$ (B) $\frac{2E}{F} + x = 0$

(C) $\frac{2F}{x} + F = 0$ (D) $\frac{2E}{x} - F = 0$

21. A progressive wave of frequency 50 Hz is travelling with velocity 350 m/s through a medium. The change in phase at given time interval of 0.01s is

(A) $\frac{\pi}{4}$ rad (B) $\frac{\pi}{2}$ rad

(C) π rad (D) $\frac{3\pi}{2}$ rad

22. When a sonometer wire vibrates in the third overtone, the number of antinodes and nodes formed on the wire are respectively

(A) $4, 5$ (B) $5, 4$

(C) $3, 4$ (D) $4, 3$

23. When the observer moves towards a stationary source with velocity 'V_1', the apparent frequency of the emitted note is 'F_1'. When the observer moves away from the source with velocity 'V_1', the apparent frequency is 'F_2'. If 'V' is the speed of sound in air and $F_1/F_2 = 2$, then $V/V_1 =$

(A) 2 (B) 3

(C) 6 (D) 8

24. The equation of wave motion is $Y = 6\sin\left(12\pi t - 0.02\pi x + \frac{\pi}{3}\right)$ where x is in metre and time in second. The velocity of the wave is

(A) 200 m/s (B) 300 m/s

(C) 400 m/s (D) 600 m/s

25. The electric field in the region is $\vec{E} = a\hat{i} + b\hat{j}$ where 'a' and 'b' are constants. The net electric flux passing through a square area of side 'l' parallel to Y-Z plane is

(A) al (B) al^4

(C) al^6 (D) al^2

26. Two point charges $q_1 = 6\ \mu C$ and $q_2 = 4\ \mu C$ are kept at points A and B in air where distance $AB = 10$ cm. What is the increase in potential energy of the system when q_2 is moved towards q_1, by 2 cm ? $\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ SI units}\right)$

(A) 21.6 J (B) 216 J

(C) 0.54 J (D) 54 J

27. The electric field between the plates of a parallel plate capacitor is 'E'. If the charge on the plates is Q then the force on each plate is

(A) QE^2 (B) QE

(C) $\frac{QE}{2}$ (D) $\frac{QE^2}{2}$

28. Two condensers of capacities, '2C' and 'C' are joined in parallel and charged upto potential 'V'. The battery is then disconnected and condenser of capacity 'C' is filled completely with a medium of dielectric constant 'K'. The potential difference across the capacitors in the second case is

(A) $\frac{3V}{(K+2)}$ (B) $\frac{V}{(K+2)}$

(C) $\frac{5V}{(K+2)}$ (D) $\frac{2V}{(K+2)}$

29. A potentiometer wire is 4m long and potential difference of 3V is maintained between the ends. The e.m.f. of the cell which balances against a length of 100 cm of the potentiometer wire is

(A) 0.75 V (B) 0.5 V

(C) 0.25 V (D) 1.5 V

30. A metre bridge experiment, the resistance in the left gap is 20 Ω and in the right gap is 60 Ω. The bridge is balanced. The distance of the null point from the centre of the wire is

(A) 50 cm (B) 75 cm

(C) 25 cm (D) 40 cm

31. The magnetic moment produced in a sample of 2 gram is $8 \times 10^{-7}\ A/m^2$. If its density is $4\ g/cm^3$ then the magnetization of the sample is

(A) 1.6 (B) 1.2

(C) 1.4 (D) 1.8

32. A wire carrying current 'I' along x axis has length 'L' and it is kept in a magnetic field $B(\hat{i} + 2\hat{j} - 2\hat{k})$ T. The magnitude of magnetic force acting on the wire is

(A) $\sqrt{8}$ ILB (B) 2 ILB

(C) 4 ILB (D) $\sqrt{2}$ ILB

33. A charged particle is moving in a uniform magnetic field in a circular path of radius 'R'. When the energy of the particle becomes 3 times the original, the new radius will be

(A) R (B) $3R$

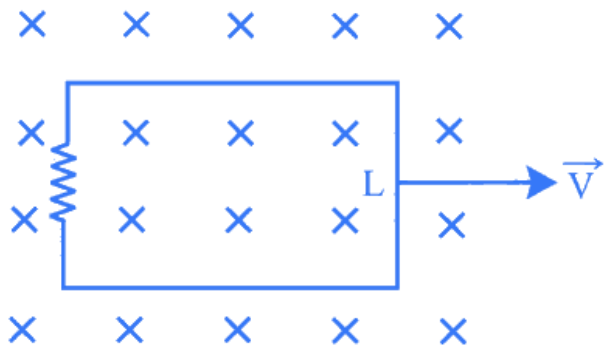
(C) $\sqrt{3}R$ (D) $R/3$

34. Torque acting on a coil carrying current 'I' situated parallel to magnetic field of induction 'B' having of turns 'n' and area 'A' is

(A) $nI(\vec{A} \cdot \vec{B})$ (B) $nI(\vec{A} \times \vec{B})$

(C) IBA/n (D) nBA/I

35. A metal rod of length 'L' completes the circuit as shown. The area of the circuit is perpendicular to magnetic field 'B'. Total resistance of the circuit is 'R'. The force needed to move the rod in the direction as shown with constant speed 'V' is



(A) $\frac{BVL}{R}$ (B) $\frac{B^2L^2V}{R}$

(C) $\frac{B^2L^2V^2}{R}$ (D) $\frac{BLV^2}{R}$

36. When a capacitor is connected in series LR circuit, the alternating current flowing in the circuit

(A) increases (B) decreases

(C) remains constant (D) is zero

37. With gradual increase in frequency of an a.c. supply, the impedance of an LCR series circuit

(A) increases (B) decreases

(C) remains constant (D) first decreases, becomes minimum and then increases

38. An alternating e.m.f. is given by $e = e_0 \sin \omega t$. In what time the e.m.f. will have half its maximum value, if 'e' Starts from zero?

(A) $\frac{T}{4}$ (B) $\frac{T}{8}$

(C) $\frac{T}{12}$ (D) $\frac{T}{16}$

39. A step down transformer has turns ratio 20:1. If 8V are applied across $0.4\,\Omega$ secondary then the primary current will be

(A) 0.5 A (B) 1 A

(C) 2 A (D) 4 A

40. A simple microscope is used to see the object first in blue light and then in red light. Due to the change from blue to red light, what is the effect on its magnifying power?

(A) decreases (B) increases

(C) remains constant (D) first increase and then decreases

41. In Young's double slit experiment, the fringe width is 0.4 mm. What is the distance between 4^{th} dark band and 6^{th} bright band on the same side of the interference pattern?

(A) 0.5 mm (B) 0.75 mm

(C) 1.0 mm (D) 1.5 mm

42. The ratio of intensities at two points on the screen in Young's double slit experiment when waves from the two slits have a path difference of zero and $\lambda/4$ is (λ is the wavelength of light used) ($\cos 0^\circ = 1$, $\cos \pi/2 = 0$)

(A) 1 : 2 (B) 2 : 1

(C) 1 : 4 (D) 4 : 1

43. In Young's double slit experiment, the distance between the slits is 3 mm and the slits are 2m away from the screen. Two interference patterns can be obtained on the screen due to light of wavelength 480 nm and 600 nm respectively. The separation on the screen between the 5^{th} order bright fringes on two interference patterns is

(A) 2×10^{-4} m (B) 1×10^{-4} m

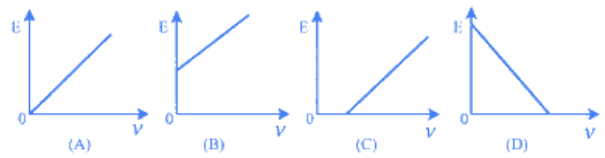
(C) 8×10^{-4} m (D) 4×10^{-4} m

44. For a photosensitive material, work function is 'W_0' and stopping potential is 'V'. The wavelength of the incident radiation is (h=Planck's constant, c = velocity of light, e = electronic charge)

(A) $\frac{hc}{(W_0 - eV)}$ (B) $\frac{hc}{(W_0 + eV)}$

(C) $hc(W_0 - eV)$ (D) $hc(W_0 + eV)$

45. Using Einstein's photoelectric equation, the graphical representation between the kinetic energy (E) of emitted Photoelectrons and the frequency of incident radiation (ν) is show correctly in figure



(A) A (B) B

(C) C (D) D

46. The force acting on the electron in hydrogen atom (Bohr's theory) is related to the principal quantum number n as

(A) n^4 (B) n^{-4}

(C) n^2 (D) n^{-2}

47. Using Bohr's atomic model, the orbital period of electron in hydrogen atom in the n^{th} orbit is (ϵ_0 =permittivity of free space, h=Planck's constant, m = mass of electron, e = electronic charge)

(A) $\frac{4\,\epsilon_0^2 n^3 h^3}{me^4}$ (B) $\frac{2\epsilon_0^2 n^2 h^3}{me^2}$

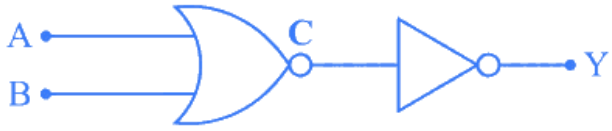
(C) $\frac{4\epsilon_0^2 n^2 h^3}{me^2}$ (D) $\frac{2\epsilon_0 n^3 h^3}{me^4}$

48. In a transistor amplifier, a change of 0.2 mA in the base current causes a change of 5 mA in the collector current. If input resistance is 2 kΩ and voltage gain is 75, the load resistance used in the circuit is

(A) 4 kΩ (B) 6 kΩ

(C) 8 kΩ (D) 2 kΩ

49. The resultant gate and its Boolean expression in the given circuit is



(A) AND, $\overline{A+B}$ (B) NAND, $A+B$

(C) OR, $A+B$ (D) NOR, $A-B$

50. When a small amount of impurity atoms are added to a semiconductor then generally its resistivity

(A) increases (B) decreases

(C) does not change (D) may increase or decrease depending upon the percentage of doping

51. Calculate the amount of aluminium present in $Al_2(SO_4)_3$ if the compound contains 4 g of sulfur.
[Molar mass of sulfur = 32 g/mol , Molar mass of Al =27 g/mol]

(A) 2.25 g
(B) 2.50 g
(C) 2.0 g
(D) 2.75 g

52. What is the observed electronic configuration of Cu ?

(A) $[Ar]\ 3d^9\ 4s^2$
(B) $[Ar]\ 3d^{10}\ 4s^1$
(C) $[Ar]\ 3d^5\ 4s^2$
(D) $[Ar]\ 3d^6\ 4s^2$

53. What is the energy of an electron in a hydrogen atom in a stationary state corresponding to n = 2 ?

(A) -5.45×10^{-19} J
(B) -2.40×10^{-19} J
(C) -4.35×10^{-18} J
(D) -6.70×10^{-18} J

54. Identify increasing order of acidity for following diprotic acids in aqueous solutions.

(A) $H_2S < H_2Se < H_2Te$
(B) $H_2Se < H_2S < H_2Te$
(C) $H_2Te < H_2S < H_2Se$
(D) $H_2Se < H_2Te < H_2S$

55. Which of the following molecules is paramagnetic?

(A) Li_2
(B) N_2
(C) O_2
(D) F_2

56. Which of the following statements is true about ideal gas ?

(A) It shows deviation from Boyle's law and Charles' law.
(B) Its molecules are not perfectly elastic.
(C) It does not exist.
(D) Intermolecular attraction is present in it, hence a collision takes place with loss of kinetic energy.

57. What is the change in entropy of surrounding for the reaction,
$H_{2(g)} + 1/2\ O_{2(g)} \rightarrow H_2O_{(l)}$
at 298 K if standard enthalpy of formation of water is -286 kJ ?

(A) 959.7 JK^{-1}
(B) 801.5 JK^{-1}
(C) 850.7 JK^{-1}
(D) 980.0 JK^{-1}

58. In a particular reaction, 4 kJ heat is released by the system and 12 kJ work done on the system. Calculate the ΔH and ΔU.

(A) $\Delta H = 4$ kJ and $\Delta U = 16$ kJ
(B) $\Delta H = -4$ kJ and $\Delta U = 8$ kJ
(C) $\Delta H = -4$ kJ and $\Delta U = -16$ kJ
(D) $\Delta H = 4$ kJ and $\Delta U = -16$ kJ

59. Which of the following relations is correct for a reaction $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$?

(A) $\Delta H > \Delta U$
(B) $\Delta H < \Delta U$
(C) $\Delta H = 0$
(D) $\Delta H = \Delta U$

60. The solubility product of a sparingly soluble salt BA is 6.4×10^{-13}. Calculate it's solubility in g dm^{-3} .
Molar mass of salt is 190 g mol^{-1} .

(A) 1.52×10^{-4}
(B) 1.25×10^{-4}
(C) 2.1×10^{-4}
(D) 1.9×10^{-4}

61. The solubility of AgCl in 0.1 M NaCl is S mol/L. If the solubility product of AgCl is 1.8×10^{-10}, then S is approximately:

(A) 1.8×10^{-9} M
(B) 1.8×10^{-10} M
(C) 1.8×10^{-11} M
(D) 1.8×10^{-12} M

62. Identify from following a weak electrolyte based on their dissociation nature in aqueous medium.

(A) NH_3
(B) NaOH
(C) KOH
(D) HI

63. What is the oxidation number of oxygen in KO_2 ?

(A) -2
(B) $-1/2$
(C) -1
(D) $+2$

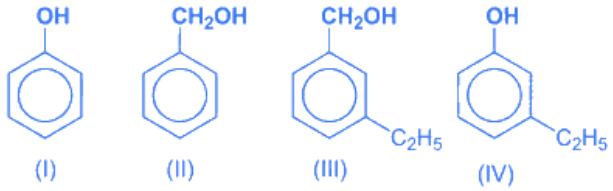
64. The most abundant element in the universe is

(A) Hydrogen (B) Sodium
(C) Magnesium (D) Potassium

65. Which of the following compounds is formed when chlorine reacts with dry slake lime $Ca(OH)_2$?

(A) $CaOCl_2$ (B) CaO_2Cl_2
(C) CaOCl (D) $CaCl_2$

66. Which of the following is an aromatic alcohol?



(A) I Only (B) II and III Only
(C) I, II, III and IV (D) I and IV Only

67. What type of following reactions, the oxidative rancidity is?

(A) addition (B) substitution
(C) free radical chain reaction (D) displacement

68. Find the number of hyperconjugation structures in the isopropyl carbocation.

(A) 3 (B) 6
(C) 9 (D) 12

69. Which from following alkenes is highly stabilized ?

(A) $R_2C = CR_2$ (B) $R_2C{=}CH_2$
(C) RCH=CHR (D) $RCH{=}CH_2$

70. Which of the following alkanes is NOT obtained when a mixture of ethyl iodide and n-propyl iodide is subjected to Wurtz reaction?

(A) n-Butane (B) Propane
(C) n-Pentane (D) n-Hexane

71. A compound forms hcp structure. What is the number of tetrahedral voids formed in 0.8 mol of it.

(A) 4.818×10^{23} (B) 9.635×10^{23}
(C) 7.227×10^{23} (D) 2.410×10^{23}

72. Calculate the number of atoms present in 90 g of metal if it forms bcc structure.
[$\rho \times a^3 = 1.8 \times 10^{-22}$ g]

(A) 4.0×10^{24} (B) 1.0×10^{24}
(C) 2.0×10^{24} (D) 3.0×10^{24}

73. In the fcc structure, the number of tetrahedral holes per sphere is

(A) 1 (B) 4
(C) 2 (D) 8

74. For a binary solution, when a nonvolatile nonelectrolyte solute is dissolved in solvent, the vapour pressure of solvent decreases by 20 % . what is mole fraction of solvent in solution ?

(A) 0.02 (B) 0.08
(C) 0.2 (D) 0.8

75. Calculate the boiling point of an aqueous solution containing 18 g glucose in 100 g water if the molal elevation constant of water is 0.5 K kg mol^{-1}.
[Molar mass of glucose = 180 g mol^{-1} and boiling point of water = 100 °C]

(A) 100 °C (B) 100.5 °C
(C) 101.0 °C (D) 101.5 °C

76. Which of the following is the colligative property of a solution?

(A) vapour pressure (B) boiling point
(C) osmotic pressure (D) Freezing point

77. Identify the reaction from following so that the standard potential of Cu^{+2}/Cu electrode is 0.34 V. with respective to SHE ?

(A) $Cu \rightarrow Cu^{+2} + 2e^-$ (B) $Cu^{+2} + 2e^- \rightarrow Cu$
(C) $Cu^{+} \rightarrow Cu^{+2} + e^-$ (D) $Cu^{+3} \rightarrow Cu^{+2} + e^-$

78. The cells A and B contain aqueous solutions of ferrous chloride and ferric chloride respectively. The mass of iron deposited by the same quantity of electricity in cells A and B is in the ratio.

(A) 1 : 1 (B) 2 : 1
(C) 3 : 1 (D) 3 : 2

79. What happens during the discharge of a lead storage battery?

(A) SO_2 is evolved (B) Pb is formed
(C) H_2SO_4 is consumed (D) $PbSO_4$ is consumed

80. The rate constant of reaction is $1.5 \times 10^7\ s^{-1}$ at 300 K and $3.0 \times 10^7\ s^{-1}$ at 330 K. What is the activation energy for the reaction? [$R \times 2.303 = 19.15\ JK^{-1}mol^{-1}$]

(A) 18.02 kJ mol^{-1} (B) 20.1 kJ mol^{-1}

(C) 19.02 kJ mol^{-1} (D) 21.5 kJ mol^{-1}

81. The rate constant for the reaction $2N_2O_5 \rightarrow 4NO_2 + O_2$ is $3.0 \times 10^{-5}\ s^{-1}$. If the rate is 2.4×10^{-5} mole $L^{-1}\ s^{-1}$ then the concentration of N_2O_5 (mol L^{-1}) is

(A) 1.4 (B) 1.2

(C) 0.04 (D) 0.8

82. What is order of radioactive decay of a substance ?

(A) 0 (B) 1

(C) 1.5 (D) 2

83. Nano materials not applied in

(A) Manufacturing of scratch proof glasses (B) Electronic devices

(C) Conventional water treatment (D) self cleaning material

84. Which of the following properties is responsible for the development of colour to the colloids?

(A) Tyndall effect (B) Brownian motion

(C) Electrophoresis (D) Electroosmosis

85. Identify the factor responsible for colour of transition metal compounds.

(A) d-d transitions (B) s-p mixing

(C) Ionisation (D) Shielding effect

86. Identify the number of unpaired electrons present and geometry respectively of $[Co(NH_3)_6]^{3+}$ complex.

(A) 0, square planar (B) 2, square planar

(C) 4, octahedral (D) 0, octahedral

87. Identify oxidation state of cobalt ion in the complex, $[Co(NH_3)_5Br]SO_4$.

(A) +2 (B) +3

(C) +1 (D) +4

88. Which of the following alkyl halides is hydrolyzed most rapidly by the SN^2 mechanism ?

(A) CH_3-Br (B) $(CH_3)_3$C-Br

(C) CH_3-CH_2-Br (D) $(CH_3)_2$CH-Br

89. Which of the following alkyl halides undergoes SN^1 reaction most readily?

(A) $(CH_3)_3$C-F (B) $(CH_3)_3$C-Cl

(C) $(CH_3)_3$C-Br (D) $(CH_3)_3$C-I

90. What is the nature of alcohols in aqueous medium?

(A) Acidic (B) Basic

(C) Neutral (D) Amphoteric

91. Which of following observations is found in Tollens test for aldehydes?

(A) The formation of pink or magenta color upon the addition of the reagent to the sample solution. (B) Formation of an Ag layer on sides of test tube upon addition and warming of the reagent.

(C) Formation of brick-red precipitate upon heating with reagent. (D) Appearance of red color upon shaking with reagent.

92. An organic compound CH_3-CH=CH-CH_2-CHO is taken in two different containers A and B. Sample in A is treated with H_2 / Ni forming new compound P. Sample in B is treated with $LiAlH_4$ and hydrolyzed further forming new compound Q. Identify P and Q.

(A) P = Q = CH_3-CH=CH-CH_2-CH_2OH

(B) P = Q = $CH_3(CH_2)_3CH_2OH$

(C) P = $CH_3(CH_2)_3CHO$ and Q = $CH_3(CH_2)_3CH_2OH$

(D) P = $CH_3(CH_2)_3CH_2OH$ and Q = CH_3-CH=CH-CH_2-CH_2OH

93. What is the common name for the simplest carboxylic acid, HCOOH ?

(A) Acetic acid (B) Formic acid

(C) Propanoic acid (D) Butanoic acid

94. Which of the following reactions uses diazonium salt ?

(A) Sandmeyer reaction (B) Mendius reaction

(C) Hofmann rearrangement reaction (D) carbylamine reaction

95. Which of the following statements is NOT correct?

(A) Primary amines show intermolecular hydrogen bonds.
(B) Tertiary butylamine is a primary amine.
(C) Tertiary amines do not show inter molecular hydrogen bonds.
(D) iso-propylamine is a secondary amine.

96. Identify the linkage in backbone of single strand of DNA ?

(A) Base- phosphate - sugar
(B) Phosphate -base - sugar
(C) Sugar -phosphate- base
(D) Phosphate -sugar- phosphate

97. Which of the following ionic species is present in hemoglobin and responsible for transformation of oxygen ?

(A) Ca^{+2}
(B) Co^{+3}
(C) Fe^{+2}
(D) Mg^{+2}

98. Which of the following processes develops cross-links in elastomer?

(A) galvanization
(B) vulcanization
(C) polymerization
(D) hydration

99. Which of the following is not a basis of classification of polymers ?

(A) Source
(B) Number of monomers
(C) Method of preparation
(D) Structure

100. Which of the following detergents is used as germicide?

(A) Anionic detergent
(B) Non ionic detergent (an ester)
(C) Cationic detergent
(D) Non ionic detergents (an ether)

101. A ball is thrown in the air. Its height at any time t is given by $h = 3 + 14t - 5t^2$, then the maximum height it can reach

(A) 12.9 (B) 12.8

(C) 12.7 (D) 12.6

102. If $(1+i)\cdot(1+2i)\ldots\ldots\ldots(1+ni) = x+iy$ (Where $i=\sqrt{-1}$), then the value of $(2)\cdot(5)\cdot(10)\ldots\ldots\ldots(1+n^2)$

(A) $\dfrac{\sqrt{x}+\sqrt{y}}{2}$ (B) x^2+y^2

(C) $\dfrac{\sqrt{x}+\sqrt{y}}{\sqrt{x}-\sqrt{y}}$ (D) x^2-y^2

103. The number of arrangements of the numbers strictly between 10 and 1000 formed with the digits 0, 1, 2, 3, 4, 5, 6 without repetition is

(A) 180 (B) 215

(C) 216 (D) 222

104. The value of $\dfrac{\sin^2 3A}{\sin^2 A} - \dfrac{\cos^2 3A}{\cos^2 A}$ is

(A) $\cos 2A$ (B) $8\cos 2A$

(C) $\dfrac{1}{8}\cos 2A$ (D) $\dfrac{1}{2}\sin 2A$

105. If $0 \le x \le \dfrac{\pi}{2}$, then the number of values of x for which $\sin x - \sin 2x + \sin 3x = 0$ is

(A) 1 (B) 2

(C) 3 (D) 4

106. The number of lines passing through A (3, 4) and the sum of whose non-zero intercepts is zero is (are)

(A) 1 (B) 2

(C) 3 (D) 4

107. If $4ab = 3h^2$, then the ratio of the slopes of the lines represented by $ax^2 + 2hxy + by^2 = 0$ is...

(A) $\sqrt{2}:1$ (B) $2:1$

(C) $\sqrt{3}:1$ (D) $1:3$

108. The equations of the tangent to the curve $x^2+y^2=10$, where the tangent is parallel to the line $2x+y-1=0$, are

(A) $2x+y=\pm\sqrt{2}$ (B) $2x+y=\pm5\sqrt{2}$

(C) $2x+y=\pm2\sqrt{2}$ (D) $2x+y=\pm3\sqrt{2}$

109. If the line $y = 2x+\lambda$ is a tangent to the hyperbola $36x^2 - 25y^2 = 3600$, then $\lambda =$

(A) ±36 (B) ±25

(C) ±16 (D) ±9

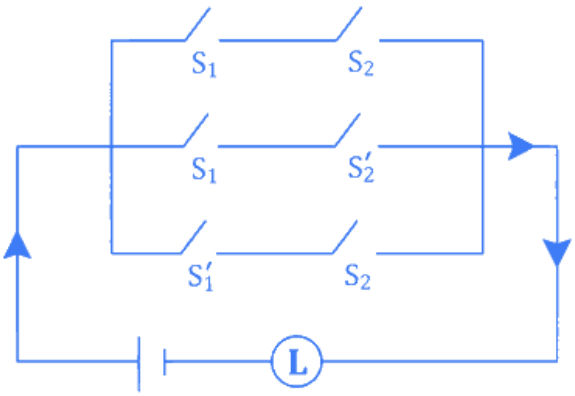
110. $\lim\limits_{x\to0} \dfrac{(5^x-1)^4 \operatorname{cosec}(x\log 5)}{\tan(x\log 5)\cdot\log(1+x^2\log 25)} = \ldots\ldots$

(A) $5\log 5$ (B) $\log\sqrt{5}$

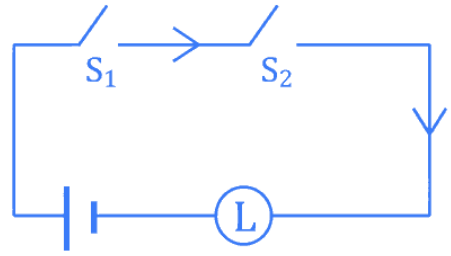
(C) $(\log 5)^2$ (D) $\dfrac{1}{4}\log 5$

111. Simplest form of the following switching circuit is

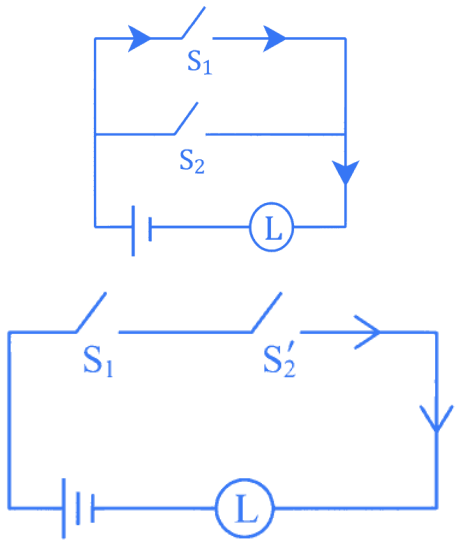
(A)



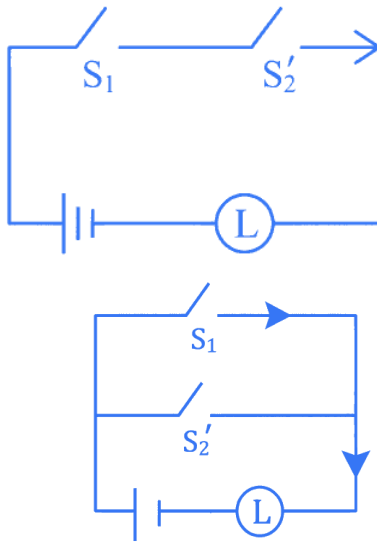
(B)



(C)



(D)



112. With usual notations in $\triangle ABC$, if $b\cos^2\frac{C}{2} + c\cos^2\frac{B}{2} = \frac{3a}{2}$ then

(A) a, b, c are in A.P. (B) a, c, b are in A.P.

(C) b, a, c are in A.P. (D) a, b, c are in G.P

113. In a triangle ABC, with usual notations $a = \sqrt{3}+1$, $b = \sqrt{3}-1$ and $\angle C = 60^\circ$ then the values of $\angle A$ and $\angle B$ respectively are

(A) $105^\circ, 15^\circ$ (B) $100^\circ, 20^\circ$

(C) $90^\circ, 30^\circ$ (D) $110^\circ, 10^\circ$

114. Inverse of $\begin{bmatrix} 3 & -2 \\ 1 & 4 \end{bmatrix}$ is

(A) $\begin{bmatrix} \frac{2}{7} & \frac{1}{7} \\ -\frac{1}{14} & \frac{3}{14} \end{bmatrix}$ (B) $\begin{bmatrix} \frac{3}{14} & -\frac{1}{7} \\ \frac{1}{14} & \frac{2}{7} \end{bmatrix}$

(C) $\begin{bmatrix} \frac{2}{7} & -\frac{1}{7} \\ \frac{1}{14} & \frac{3}{14} \end{bmatrix}$ (D) $\begin{bmatrix} -\frac{3}{14} & \frac{1}{7} \\ \frac{1}{14} & \frac{2}{7} \end{bmatrix}$

115. If $A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$ and $A(\text{adj } A) = AA^T$, Then $5a + b =$

(A) 2 (B) 3

(C) 5 (D) $\frac{15}{2}$

116. If $y = \tan^{-1}\left[\frac{x-\sqrt{1-x^2}}{x+\sqrt{1-x^2}}\right]$, then $\frac{dy}{dx} =$

(A) $\frac{-1}{\sqrt{1-x^2}}$ (B) $\frac{1}{\sqrt{1-x^2}}$

(C) 1 (D) -1

117. $\cos\left(\cos^{-1}\left(-\frac{1}{2}\right) + \frac{\pi}{3}\right) =$

(A) 0 (B) -1

(C) 1 (D) $\frac{1}{2}$

118. $\sin^{-1}\left(\frac{12}{13}\right) + \cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{63}{16}\right) =$

(A) $\frac{\pi}{2}$ (B) $\frac{3\pi}{2}$

(C) π (D) 2π

119. If $f(x) = \frac{4x+3}{6x-4}$, $x \neq \frac{2}{3}$ and $(\text{fof})(x) = g(x)$ where $g : \mathbb{R} - \left\{\frac{2}{3}\right\} \to \mathbb{R} - \left\{\frac{2}{3}\right\}$, then $(gogogogogog)(3) =$

(A) 3 (B) $\frac{1}{3}$

(C) 3^5 (D) $\frac{1}{3^5}$

120. If the derivative of the function $f(x) = \begin{cases} ax^2 + b & \text{if } x < -1 \\ bx^2 + ax + 4 & \text{if } x \geq -1 \end{cases}$ is continuous everywhere then

(A) $a = 2, b = 3$ (B) $a = 3, b = 2$

(C) $a = -2, b = 3$ (D) $a = -3, b = -2$

121. The derivative of $\log_8(\log_5 x)$ w. r. t. x is

(A) $\frac{1}{\log_5 8 \log x}$ (B) $\frac{1}{x \log 5 \log x}$

(C) $\frac{1}{x \log x \log 8 \log 5}$ (D) $\frac{1}{x \log 8 \log x}$

122. If $y^{\frac{1}{m}} + y^{\frac{-1}{m}} = 2x$, then $(x^2 - 1)y_1^2 =$

(A) my^2 (B) m^2y^2

(C) m^2y (D) my

123. A triangle has two fixed vertices A $(a, 0)$ and B$(0, b)$. Let its third vertex C is moving along the line $x = y$. If s is the area of triangle ABC, then $\frac{ds}{dx} =$

(A) $a + b$ (B) $-\left(\frac{a+b}{2}\right)$

(C) $\frac{a-b}{2}$ (D) $\frac{a}{2}$

124. The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in the interval.....

(A) $\left(0, \frac{\pi}{2}\right)$ (B) $\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$

(C) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (D) $\left(\frac{-\pi}{2}, \frac{\pi}{4}\right)$

125. The minimum value of $\frac{\log x}{x}$ in the interval $(2, \infty)$ is

(A) 0 (B) e

(C) $\frac{1}{e}$ (D) Does not exist

126. $\int \frac{(x+1)(x+\log x)^2}{x} dx =$

(A) $\left(\frac{x+\log x}{x}\right)^2 + c$, where c is the constant of integration

(B) $\frac{(x+\log x)^2}{x} + c$, where c is the constant of integration

(C) $\frac{(x+\log x)^3}{3} + c$, where c is the constant of integration

(D) $\frac{(x+\log x)^3}{3x} + c$, where c is the constant of integration

127. $\int \cot^4 x \, dx$ is equal to

(A) $\frac{\cot^3 x}{3} - \cot x + x + c$

(B) $\frac{\cot^3 x}{3} + \cot x + x + c$

(C) $-\frac{\cot^3 x}{3} + \cot x + x + c$

(D) $\frac{\cot^3 x}{3} - 2\cot x + x + c$

128. $\int \frac{\cos^3 x}{\sin^2 x + \sin x} dx =$

(A) $\log(\cos x) + \cos x + c$, where c is the constant of integration

(B) $\log(\sin x) - \sin x + c$, where c is the constant of integration

(C) $\log(\sin x) + \sin x + c$, where c is the constant of integration

(D) $\log(\cos x) - \cos x + c$, where c is the constant of integration

129. $\int_{\pi/6}^{\pi/3} \frac{\sin x - \cos x}{1 + \sin x \cos x} dx =$

(A) 0 (B) $\frac{\pi}{12}$

(C) $\frac{\pi}{24}$ (D) $\frac{\pi^2}{2}$

130. $\int_0^{\log 5} \frac{e^x \sqrt{e^x - 1}}{e^x + 3} dx =$

(A) $2 - \frac{\pi}{4}$ (B) $4 - \frac{\pi}{4}$

(C) $2 - \pi$ (D) $4 - \pi$

131. The integrating factor of the differential equation $(1+t^2)+\left(x-e^{\tan^{-1}t}\right)\frac{dt}{dx}=0$ is

(A) $e^{\tan^{-1}t}$ (B) $-e^{\tan^{-1}t}$

(C) $e^{-\tan^{-1}t}$ (D) $-e^{-\tan^{-1}t}$

132. The degree of the differential equation obtained from the equation $(y-a)^2=4(x-b)$ [where a and b are arbitrary constants] is

(A) 1 (B) 2

(C) 3 (D) not defined

133. The solution of the differential equation $\left(x+2y^3\right)\frac{dy}{dx}-y=0$ is

(A) $x=(c+y^2)y$, where c is the constant of integration (B) $y=(c+y^2)x$, where c is the constant of integration

(C) $x=(c+y)y$, where c is the constant of integration (D) $y=(c+x^2)$, where c is the constant of integration

134. The rate of reduction is proportional to the square root of a persons existing assets at that moment. If his assets at the beginning are 10000 and they dwindle down to 5625 in 2 years, then the person will be bankrupt in

(A) 4 years (B) 6 years

(C) 8 years (D) 10 years

135. If a vector $3\hat{i}+4\hat{j}-5\hat{k}$ is rotated through a certain angle about the origin in the anti-clockwise direction, then the components of the new vector are $a+1,-3,5$. The possible values of a is

(A) 5 or 3 (B) 5 or -3

(C) 4 or -2 (D) -5 or 3

136. Let A, B, C, D be the points in the plane with position vectors $-2\hat{i}-\hat{j}$, $4\hat{i}$, $3\hat{i}+3\hat{j}$ and $-3\hat{i}+2\hat{j}$ respectively, then $\square$ABCD is

(A) a parallelogram which is neither a rhombus nor a reactangle (B) a square

(C) a rectangle but not a square (D) a rhombus but not a square

137. Let $\bar{a}=\hat{i}+\hat{j}$, $\bar{c}=\hat{i}-\hat{j}$ and a vector $\bar{b}$ be such that $\bar{a}\times\bar{b}=\bar{c}$ and $\bar{a}\cdot\bar{b}=3$ then $|\bar{b}|=$

(A) $\frac{11}{\sqrt{2}}$ (B) $\frac{11}{\sqrt{3}}$

(C) $\sqrt{\frac{11}{2}}$ (D) $\sqrt{\frac{11}{3}}$

138. The acute angle between the vector $2\hat{i}+\hat{j}-3\hat{k}$ and the plane containing the vectors $2\hat{i}+3\hat{j}-\hat{k}$ and $\hat{i}-\hat{j}+2\hat{k}$ is

(A) $\sin^{-1}\left(\frac{4}{\sqrt{42}}\right)$ (B) $\cos^{-1}\left(\frac{4}{\sqrt{42}}\right)$

(C) $\sin^{-1}\left(\frac{3}{\sqrt{42}}\right)$ (D) $\cos^{-1}\left(\frac{3}{\sqrt{42}}\right)$

139. A parallelogram is constructed on $5\bar{a}+2\bar{b}$ and $\bar{a}-3\bar{b}$ as its adjacent sides, with $|\bar{a}|=2\sqrt{2},|\bar{b}|=3$. The angle between $\bar{a}$ and $\bar{b}$ is $\frac{\pi}{4}$. Then the length of the diagonals of the parallelogram are

(A) $15,\sqrt{593}$ (B) 15, 593

(C) 225, 593 (D) 20, 593

140. The lines $\frac{x-2}{1}=\frac{y-3}{1}=\frac{z-4}{-k}$ and $\frac{x-1}{k}=\frac{y-4}{2}=\frac{z-5}{1}$ are coplanar if

(A) $k=0,-3$ (B) $k=-1,3$

(C) $k=1,2$ (D) $k=2,4$

141. The direction ratios of the normal to the plane passing through (1, 0, 0), (0, 1, 0) which makes an angle of measure 45° with the plane $2x+3y=7$ are....

(A) $\sqrt{6}$, 1, 1 (B) 1, 1, $\sqrt{6}$

(C) $\sqrt{13}$, $\sqrt{13}$, $\sqrt{6}$ (D) $\sqrt{13}$, $\sqrt{13}$, $2\sqrt{6}$

142. The lines $\frac{x-1}{-1}=\frac{y+2}{1}=\frac{z-3}{-2}$ and $\frac{x-1}{1}=\frac{y+2}{1}=\frac{z+1}{-2}$ are

(A) intersecting but not perpendicular (B) parallel

(C) perpendicular (D) skew lines

143. If the product of the distances of the point (1, 2, 3) from the origin and the plane $2x-3y+z+k=0$ is 7, then the value of k is

(A) 8 (B) 10

(C) 7 (D) 5

144. The vector equation of the line whose cartesian equations are $x = 2, 2y - 3z + 7 = 0$

(A) $\vec{r} = (2\hat{i} + 2\hat{j} - 3\hat{k}) + \lambda(2\hat{j} - 3\hat{k})$

(B) $\vec{r} = (2\hat{i} + 2\hat{j} - 3\hat{k}) + \lambda(2\hat{i} - 3\hat{j})$

(C) $\vec{r} = \left(2\hat{i} + \frac{7}{3}\hat{k}\right) + \lambda(3\hat{j} + 2\hat{k})$

(D) $\vec{r} = \left(-2\hat{i} + \frac{7}{3}\hat{k}\right) + \lambda(3\hat{j} + 2\hat{k})$

145. The feasible region represented by the constraints
$y - 2x \leq 4, x + y \geq 5, x \leq 4, y \geq 2, x, y \geq 0$ is .....

(A) a convex bounded region with 4 corner points

(B) an unbounded region

(C) a convex bounded region with 5 corner points

(D) no feasible region

146. A fair die is thrown at random. Let A be the event that the number obtained on the die is a non-even prime number and B be the event that the number obtained on the die is an odd number.
Let $p : P(A) = \frac{1}{3}$, q : A and B are independent events.
Then the truth values of statements p and q respectively are.....

(A) T , T

(B) T , F

(C) F , T

(D) F , F

147. Three ships A, B, C sail from England to India. If the odds in favour of their safe arrival are 2:5, 3:7 and 6:11 respectively, then the probability that the exactly two ships arrive safely is

(A) $\frac{24}{119}$

(B) $\frac{24}{1190}$

(C) $\frac{66}{1190}$

(D) $\frac{84}{1190}$

148. A random variable X has the probability distribution

$X = x$	1	2	3	4	5	6	7	8
$P(X = x)$	0.23	0.15	0.12	0.10	0.20	0.07	0.08	0.05

for the events E = {X is a prime number} and F = {X ≤ 3}, then P (E∪F) =

(A) 0.55

(B) 0.70

(C) 0.87

(D) 0.78

149. The probability distribution of a random variable X is given by

$X = x$	1	2	3	4
$P(X = x)$	k	$2k$	$3k$	$4k$

Then the c.d.f. of X is given by

(A)

$X = x$	1	2	3	4
$F(X = x)$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{6}{10}$	1

(B)

$X = x$	1	2	3	4
$F(X = x)$	$\frac{3}{10}$	$\frac{1}{10}$	$\frac{6}{10}$	1

(C)

$X = x$	1	2	3	4
$F(X = x)$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{5}{10}$	$\frac{1}{10}$

(D)

$X = x$	1	2	3	4
$F(X = x)$	$\frac{1}{10}$	$\frac{6}{10}$	$\frac{3}{10}$	1

150. Two dice are thrown successively 4 times and getting a doublet is called a success. The probability of getting at least 1 success is

(A) $\frac{50}{1296}$

(B) $\frac{1246}{1296}$

(C) $\frac{625}{1296}$

(D) $\frac{671}{1296}$

- End of Question Paper -